

Predictors of Cigarette Smoking and Smoking Cessation Among Adults With Asthma

ABSTRACT

Objectives. This study sought to determine the predictors of smoking and time until smoking cessation in a cohort of adults with asthma.

Methods. Adults with asthma (n=374) in northern California completed structured telephone interviews at baseline and 18-month follow-up.

Results. Of the 374 subjects, 156 reported ever having smoked, and 39 indicated that they currently smoked. Earlier birth cohort, lower educational attainment, White race, and presence in childhood residence of an adult who smoked were associated with a greater risk of ever smoking. Lower educational attainment, early smoking initiation, higher daily cigarette consumption, and late-childhood-onset asthma were associated with a longer interval until smoking cessation.

Conclusions. Persons with asthma at high risk of cigarette smoking and delayed quitting can be identified on the basis of clinical and demographic characteristics. (*Am J Public Health.* 2000; 90:1307–1311)

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Asthma is a costly chronic health condition, both in terms of health care expenditures and impact on the daily lives of those affected.^{1,2} Because the prevalence of asthma has risen dramatically in recent years,² its social and economic impact continues to increase. Clinical care that focuses on avoiding exacerbating factors, such as cigarette smoking, has become a national priority.³

Remarkably, up to half of US adults with asthma have regularly smoked cigarettes.^{4–6} Despite this high lifetime prevalence, the factors predisposing asthmatic persons to initiate smoking are not well understood. Furthermore, the predictors of smoking cessation, which is a clear priority in adults with asthma, have not been previously examined. The current study investigated smoking and smoking cessation among adults with asthma.

Methods

We used data collected during a prospective cohort study, conducted between 1993 and 1996, of adults with asthma recruited from physician practices in northern California. Details on the study design have been previously reported.^{7–9} In brief, we recruited a random sample of certified American Board of Medical Specialty internal medicine and pulmonary specialists (n=68) and internal medicine and allergy/immunology specialists (n=17). Participating physicians maintained a registry of persons aged 18 to 50 years with outpatient visits for asthma over a prospective 4-week period. Each person registered by a participating physician was contacted to arrange a structured, computer-assisted telephone interview covering asthma history, health status, and demographic characteristics. We evaluated cigarette smoking history with questions adapted from the National Health Interview Survey.¹⁰

In this study, we report data from 374 of 601 subjects (62%) who initially participated in baseline study interviews and 246 subjects (66%) who participated in 18-month follow-up interviews. This restricted data set excluded 21 baseline subjects who were found to be outside the study age range and 206 baseline subjects with inconsistent data during subsequent reinterview. Among the 374 baseline subjects, the present study excluded an additional 130 subjects at 18-month follow-up interview who

had inconsistent data at later interviews, leaving 244 follow-up (18-month) interviews. These exclusions had only a minimal effect on the study findings.

We used multiple logistic regression analysis to elucidate the independent predictors of lifetime smoking. In the stratum of ever smoking subjects, we constructed a Kaplan–Meier curve to illustrate time until smoking cessation. We used Cox proportional hazards regression to determine the independent predictors of time until smoking cessation.

Using baseline data, we calculated time until smoking cessation for ex-smokers by subtracting age at smoking initiation from age at cessation. For subjects who remained current smokers at baseline, we then used prospective data at the 18-month follow-up. Time until smoking cessation was calculated as before, by subtracting age at smoking initiation from age at quitting. At the baseline interview, current smokers without further follow-up were censored.

Results

Among 374 adults with asthma, 156 reported ever having smoked cigarettes (42%; 95% confidence interval [CI]=37%, 47%). Only 39 subjects indicated current smoking at the baseline interview (10%; 95% CI=8%, 14%). On average, smoking initiation occurred during adolescence (mean \pm SD=16.4 \pm 3.2 years; median=16 years).

In a multivariate analysis, earlier birth cohort was associated with an increased risk of

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TABLE 1—Subject Characteristics Associated With Ever Smoking Cigarettes Among 374 California Adults With Asthma: 1993–1996

Characteristic	Never Smokers (n=218) No. (%)	Ever Smokers (n=156) No. (%)	Multivariate Odds Ratio ^a (95% Confidence Interval)
Decade of birth*			
1970–1979	15 (83)	3 (17)	1.0
1960–1969	55 (71)	22 (29)	2.7 (0.6, 12.0)
1950–1959	77 (53)	69 (47)	5.7 (1.4, 23.0)
1940–1949	71 (53)	62 (47)	5.0 (1.2, 20.0)
Sex			
Male	64 (57)	48 (43)	1.0
Female	154 (59)	108 (41)	0.9 (0.6, 1.5)
Race*			
Non-White	79 (66)	41 (34)	1.0
White, non-Hispanic	139 (55)	115 (45)	1.7 (1.0, 2.8)
Education (highest level completed)*			
College or graduate school	94 (69)	43 (31)	1.0
Some college	83 (60)	55 (40)	1.3 (0.8, 2.3)
High school	36 (45)	44 (55)	2.8 (1.5, 5.3)
Less than grade 12	5 (26)	14 (74)	5.3 (1.5, 18.0)
Atopic history*			
Absent	31 (46)	36 (54)	1.0
Present	187 (61)	120 (39)	0.7 (0.4, 1.2)
Age at first asthma attack			
Adulthood (>18 y)	101 (53)	89 (47)	...
Late childhood/adolescence (10 to 18 y)	27 (63)	16 (37)	...
Early childhood (<10 y)	90 (64)	51 (36)	...
History of asthma remission (1 y or more)			
Yes	57 (59)	40 (41)	...
No	161 (58)	116 (42)	...
Childhood exposure to environmental tobacco smoke			
None*	185 (65)	98 (35)	...
Mother smoked regularly*	53 (42)	74 (58)	1.6 (1.0, 2.6)
Father smoked regularly*	69 (45)	83 (55)	1.5 (0.9, 2.5)
Other household member smoked regularly*	16 (27)	44 (73)	3.7 (1.9, 7.3)

^aBased on multiple logistic regression analysis. Hosmer–Lemeshow test indicated adequate model goodness of fit ($P > .50$).

* $P < .05$ (bivariate comparison).

ever smoking (Table 1). Lower educational attainment was related to a greater risk of ever smoking than was completion of college. White race and presence in childhood residence of an adult who smoked were also associated with a greater risk of ever smoking. There was no statistical interaction between educational attainment and birth cohort ($P > .20$).

Among ever smokers, the median time until smoking cessation was 17 years (95% CI=14, 19; see Figure 1). A Cox proportional hazards regression identified several independent predictors of time until smoking cessation (Table 2). In comparison with college- or graduate-level educational attainment, completion of less than 12th grade was related to a longer period until smoking cessation. Age at smoking initiation also predicted smoking cessation, with younger initiation (13 years or younger) associated with longer time until cessation. These confidence intervals, however, did not exclude the possibility of no effect.

Daily cigarette consumption of more than one-half pack was also related to a longer time until smoking cessation. Conversely, in comparison with early childhood onset of asthma

symptoms, onset in late childhood or adolescence was associated with more rapid quitting. Atopic history also was associated with a shorter time until smoking cessation.

Discussion

A surprising number of persons with asthma smoke cigarettes during their lifetime, despite the presence of chronic respiratory disease. The prevalence of lifetime (42%) and current smoking (10%) among adults with asthma in our study was substantial, albeit somewhat lower than that among the general population.^{11,12} Nationwide, 48% of adults report ever having smoked, with fewer indicating current smoking (24.7%).¹¹ The prevalence of current smoking is considerably lower among adults living in California (15.5%).¹²

Many of the risk factors for smoking among adults with asthma observed here are similar to those found in the general population, such as earlier birth cohort and lower educational attainment. Of the asthma-specific factors we evaluated, age at asthma onset, history

of asthma remission, and atopic status were not associated with the risk of ever smoking.

Of all demographic characteristics, low educational attainment is the most potent predictor of increased smoking prevalence in the general population.^{11,13–16} We demonstrated a similar strong association between education and smoking status, suggesting that socioeconomic factors also influence smoking initiation among persons with asthma. Furthermore, we found that low educational attainment remained a risk factor for smoking in birth cohorts preceding and following widespread publication of information on the health effects of smoking (i.e., there was no statistical interaction between education and birth cohort).

In the general population, sex also has a marked influence on smoking prevalence rates, which are higher among men than among women.^{11,14–19} Despite earlier studies suggesting that males with asthma are more likely to have smoked than females,^{6,20,21} a recent study suggested the reverse.⁴ In contrast, we found no statistical association between sex and smoking after controlling for other demographic and clinical covariates.

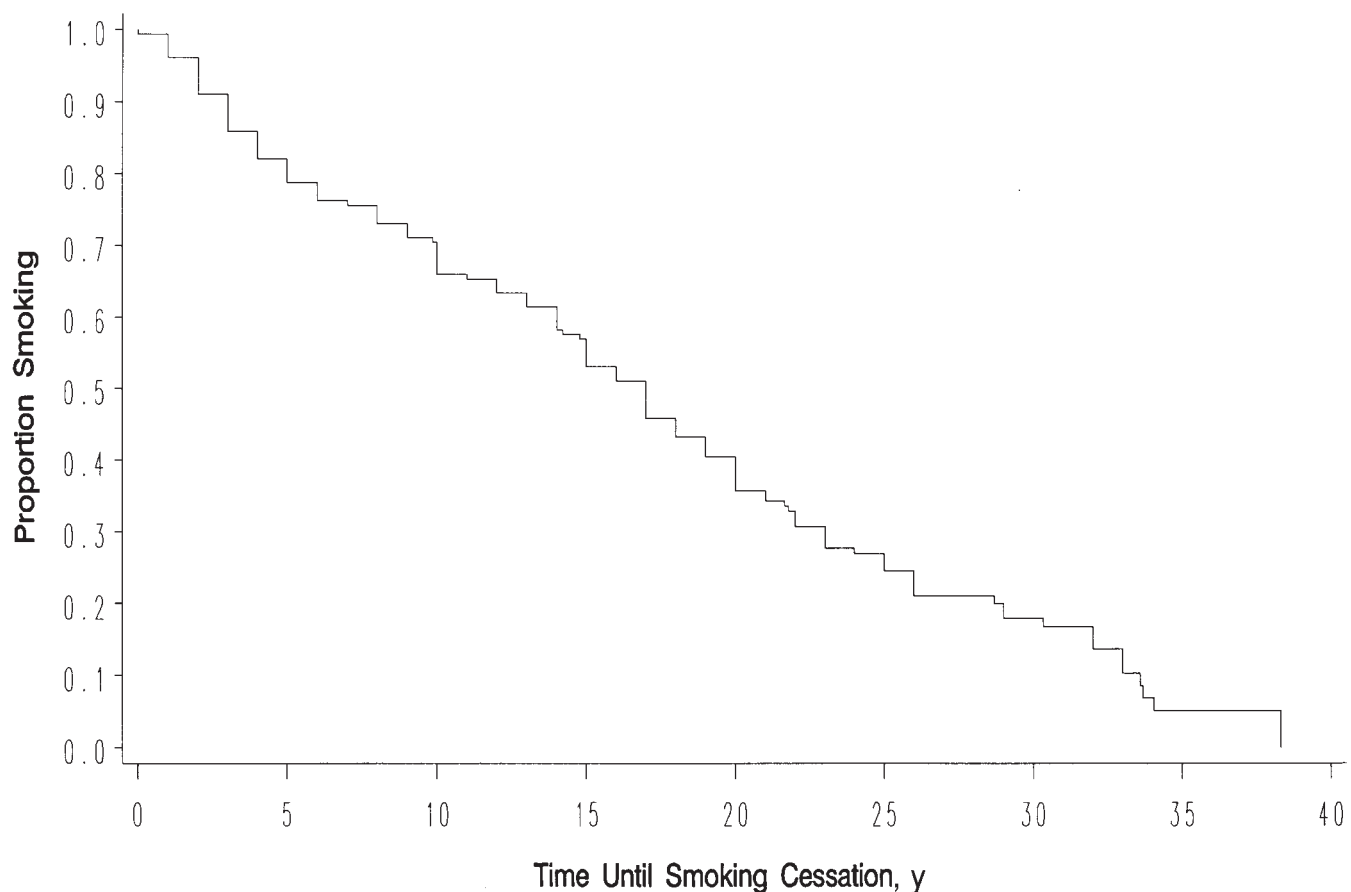


FIGURE 1—Kaplan–Meier curve depicting time until smoking cessation among 156 adult asthmatic subjects who had ever smoked cigarettes: California, 1993–1996.

The association of race with smoking prevalence has been well described in the general US population, with high smoking rates in Native Americans, intermediate rates in Whites and Blacks, and lower rates in Hispanics and Asians.^{11,13,14,16,18,22} Despite this evidence, we found no published studies examining the impact of race on smoking in persons with asthma. The observed association between White race and increased risk of smoking is consistent with findings from studies of nationally representative samples. Because the risk persists after adjustment for educational attainment, the association between race and smoking probably does not reflect confounding by socioeconomic status (although the confidence interval did not exclude the possibility of no effect).

Of the asthma-related factors, adolescent asthma onset was associated with a shorter duration of smoking. Because these subjects started smoking soon after their asthma symptoms began (median interval: 2 years), perception of a temporal relationship between cigarette smoking and respiratory symptoms may

have resulted in faster cessation. This observation is consistent with the “healthy smoker effect,”²³ in which people who initiate and maintain regular smoking have better pulmonary function and fewer respiratory symptoms than nonsmokers.

Although male sex has been associated with increased rates of smoking cessation in the general population,^{14,17,24–28} we found no effect of sex on duration of smoking among adults with asthma. Our data suggest that White race is associated with more rapid smoking cessation, which has also been described in nationally representative samples.^{17,24–26,28} The observed association between low educational attainment and delayed smoking cessation among adults with asthma is consistent with studies of the general population.^{14,25,27–32} Furthermore, earlier age at smoking initiation²⁹ and greater daily cigarette consumption,^{27,28,32,33} which may reflect heavier nicotine dependence, have been linked to longer duration of smoking in nonclinical populations.

The present study is subject to several limitations. Because smoking cessation preceded

baseline interviews among most subjects, we were unable to evaluate the impact of asthma severity and other clinical factors on smoking behavior during prospective follow-up. As a result, our analyses were confined to demographic characteristics, atopic status, and clinical asthma course (onset and remission). Despite our recruitment strategy, some subjects diagnosed with asthma could actually have had another respiratory disease, such as chronic obstructive pulmonary disease. Furthermore, reliance on self-reported smoking habits could have resulted in misclassification of some subjects. Finally, our study was based on subjects recruited from specialty practices, and our findings may thus be less generalizable to the general population of adults with asthma.

Because cigarette smoking is common in people with asthma, smoking prevention and cessation should be priorities in clinical asthma care. Asthmatic adults with early childhood asthma onset, early smoking initiation, or heavy daily cigarette consumption may require intensive smoking cessation interventions. □

TABLE 2—Current Smoking and Time Until Smoking Cessation Among Adults With Asthma: California, 1993–1996

Characteristic	Ex-Smoker (n = 119)	Current Smoker (n = 39)	Relative Hazard for Time Until Smoking Cessation ^a (95% Confidence Interval)
Sex			
Male	39 (81)	9 (19)	...
Female	80 (74)	28 (26)	...
Race*			
Non-White	26 (63)	15 (37)	1.0
White, non-Hispanic	93 (81)	22 (19)	1.5 (0.9, 2.3)
Education (highest level completed)**			
College or graduate school	83 (85)	15 (15)	1.0
High school	29 (66)	15 (34)	0.8 (0.5, 1.2)
Less than grade 12	7 (50)	7 (50)	0.5 (0.2, 1.07)
Atopic history*			
Absent	23 (64)	13 (36)	1.0
Present	96 (80)	24 (20)	1.6 (1.0, 2.5)
Age at smoking initiation, y			
17 or older	58 (78)	16 (22)	1.0
14 to 16	38 (75)	13 (25)	0.7 (0.4, 1.1)
13 or younger	23 (74)	8 (26)	0.66 (0.4, 1.09)
Age at first asthma attack			
Early childhood (<10 y)	41 (80)	10 (20)	1.0
Late childhood/adolescence (10 to 18 y)	13 (81)	3 (19)	1.9 (1.0, 3.6)
Adulthood (>18 y)	65 (73)	24 (27)	1.1 (0.7, 1.6)
History of asthma remission (1 y or more)			
Yes	30 (75)	10 (25)	...
No	89 (77)	27 (23)	...
Childhood exposure to environmental tobacco smoke			
None**	87 (89)	11 (11)	...
Mother smoked regularly	54 (73)	20 (27)	1.2 (0.8, 1.9)
Father smoked regularly	59 (71)	24 (29)	1.0 (0.7, 1.5)
Other household member smoked regularly	33 (75)	11 (25)	1.0 (0.6, 1.6)
Daily personal cigarette consumption (packs/day)			
Less than 0.5	29 (88)	4 (12)	1.0
Between 0.5 and 1	28 (72)	11 (28)	0.5 (0.3, 0.8)
1	44 (73)	16 (27)	0.5 (0.3, 0.8)
More than 1	18 (75)	6 (25)	0.4 (0.2, 0.7)

Note. Columns 2 and 3 show bivariate comparison of current vs ex-smokers. Relative hazard > 1 indicates shorter time until quitting; relative hazard < 1 indicates longer time until quitting.

^aCox proportional hazard model with outcome of time until smoking cessation.

P* = .10; *P* = .05 (bivariate comparison).

Contributors

M. D. Eisner developed the study plan, conceived and performed the analysis, and wrote and edited the manuscript. E. H. Yelin provided critical feedback for data analysis and editorial input into the manuscript. P. P. Katz provided conceptual input into the data analysis. S. C. Shiboski provided biostatistical assistance for data analysis. J. Henke assisted with data analysis. As principal investigator, P. D. Blanc conceived and developed the cohort study and provided critical feedback for data analysis. P. P. Katz, S. C. Shiboski, J. Henke, and P. D. Blanc provided critical reviews of the manuscript.

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References

- Smith DH, Malone DC, Lawson KA, Okamoto LJ, Battista C, Saunders WB. A national estimate of the economic costs of asthma. *Am J Respir Crit Care Med*. 1997;156:787–793.
- Prevalence of selected chronic conditions: United States, 1990–92. *Vital Health Stat* 10. 1997;No. 194.
- Guidelines for the Diagnosis and Management of Asthma*. Bethesda, Md: National Heart, Lung and Blood Institute, National Institutes of Health; 1997. NIH publication 97-4051A.
- Osborne ML, Vollmer WM, Linton KL, Buist AS. Characteristics of patients with asthma within a large HMO. A comparison by age and gender. *Am J Respir Crit Care Med*. 1998;157:123–128.
- Troisi RJ, Speizer FE, Rosner B, Trichopoulos D, Willett WC. Cigarette smoking and incidence of chronic bronchitis and asthma in women. *Chest*. 1995;108:1557–1561.
- Burrows B, Barbee RA, Cline MG, Knudson RJ, Lebowitz MD. Characteristics of asthma among elderly adults in a sample of the general population. *Chest*. 1991;100:935–942.
- Blanc PD, Cisternas M, Smith S, Yelin EH. Asthma, employment status, and disability among adults treated by pulmonary and allergy specialists. *Chest*. 1996;109:688–696.
- Eisner MD, Katz PP, Yelin EH, Henke J, Smith S, Blanc PD. Assessment of asthma severity in adults with asthma treated by family practitioners, allergists, and pulmonologists. *Med Care*. 1998;35:1567–1577.
- Blanc PD, Katz PP, Henke J, Smith S, Yelin EH. Pulmonary and allergy subspecialty care in adults with asthma. Treatment, use of services, and health outcomes. *West J Med*. 1997;167:398–407.
- Current estimates from the National Health Interview Survey. *Vital Health Stat* 10. 1989;No. 173.
- Cigarette smoking among adults—United States, 1995. *MMWR Morb Mortal Wkly Rep*. 1997;46:1217–1220.
- State-specific prevalence of cigarette smoking—United States, 1995. *MMWR Morb Mortal Wkly Rep*. 1996;45:962–966.
- Escobedo LG, Anda RF, Smith PF, Remington PL, Mast EE. Sociodemographic characteristics of cigarette smoking initiation in the United States. Implications for smoking prevention policy. *JAMA*. 1990;264:1550–1555.
- Escobedo LG, Peddicord JP. Smoking prevalence

- in US birth cohorts: the influence of gender and education. *Am J Public Health*. 1996;86:231–236.
15. Pierce JP, Fiore MC, Novotny TE, Hatziandreu EJ, Davis RM. Trends in cigarette smoking in the United States. Educational differences are increasing. *JAMA*. 1980;261:56–60.
 16. Winkleby MA, Schooler C, Kraemer HC, Lin J, Fortmann SP. Hispanic versus white smoking patterns by sex and level of education. *Am J Epidemiol*. 1995;142:410–418.
 17. Fiore MC, Novotny TE, Pierce JP, Hatziandreu EJ, Patel MK, Davis RM. Trends in cigarette smoking in the United States. The changing influence of gender and race. *JAMA*. 1989;261:49–55.
 18. Lowry R, Kann L, Collins JL, Kolbe LJ. The effect of socioeconomic status on chronic disease risk behaviors among US adolescents. *JAMA*. 1996;275:792–797.
 19. Bachman JG, Wallace JM, O'Malley PM, Johnston LD, Kurth CL, Neighbors HW. Racial/ethnic differences in smoking, drinking, and illicit drug use among American high school seniors, 1976–89. *Am J Public Health*. 1991;81:372–377.
 20. Schacter EN, Doyle CA, Beck GJ. A prospective study of asthma in a rural community. *Chest*. 1984;85:623–630.
 21. Oechsli FW, Seltzer CC, van den Berg BJ. Adolescent smoking and early respiratory disease: a longitudinal study. *Ann Allergy*. 1987;59:135–139.
 22. Hovell MF, Slymen DJ, Keating KJ, et al. Tobacco use prevalence and correlates among adolescents in a clinician initiated tobacco prevention trial in California, USA. *J Epidemiol Community Health*. 1996;50:340–346.
 23. Becklake MR, Lalloo U. The healthy smoker: a phenomenon of health selection? *Respiration*. 1990;57:137–144.
 24. Selected cigarette smoking initiation and quitting behaviors among high school students—United States, 1997. *MMWR Morb Mortal Wkly Rep*. 1998;47:386–389.
 25. Cigarette smoking among adults—United States, 1993. *MMWR Morb Mortal Wkly Rep*. 1994;43:925–929.
 26. Escobedo LG, Remington PL. Birth cohort analysis of prevalence of cigarette smoking among Hispanics in the United States. *JAMA*. 1989;261:66–69.
 27. Coombs RB, Li S, Kozlowski LT. Age interacts with heaviness of smoking in predicting success in cessation of smoking. *Am J Epidemiol*. 1992;135:240–246.
 28. Nidels MA, Rakos RF, Gonzales D, et al. Predictors of initial smoking cessation and relapse through the first 2 years of the Lung Health Study. *J Consult Clin Psychol*. 1995;63:60–69.
 29. Breslau N, Peterson EL. Smoking cessation in young adults: age at initiation of cigarette smoking and other suspected influences. *Am J Public Health*. 1996;86:214–220.
 30. Flint AJ, Novotny TE. Poverty status and cigarette smoking prevalence and cessation in the United States, 1983–1993: the independent risk of being poor. *Tob Control*. 1997;6:14–18.
 31. Smoking cessation during previous year among adults—United States, 1990 and 1991. *MMWR Morb Mortal Wkly Rep*. 1993;42:504–507.
 32. Freund KM, D'Agostino RB, Belanger AJ, Kannel WB, Stokes J. Predictors of smoking cessation: the Framingham study. *Am J Epidemiol*. 1992;135:957–964.
 33. Sargent JD, Mott LA, Stevens M. Predictors of smoking cessation in adolescents. *Arch Pediatr Adolesc Med*. 1998;152:388–393.